

Creating Temporary Venues for High Demanding Classical Concerts using a Room Enhancement System

G. Engel¹, M. Blome²

¹ Müller-BBM GmbH, 82152 Planegg, Germany, Email: Gunter.Engel@MuellerBBM.de

² Müller-BBM GmbH, 82152 Planegg, Germany, Email: Marcus.Blome@MuellerBBM.de

Introduction

In the field of classical concerts an increasing tendency of arranging concerts in unusual and sometimes unsuitable venues can be observed. There are various possibilities to acoustically improve these venues, but most of them turn out to be impracticable due to the limited preparation time and an unacceptable appearance of the acoustical measures. In many cases the only solution can be provided by the use of room enhancement systems, which counteract the acoustic deficiencies with electro acoustical means.

This paper describes the basic functionality of room enhancement systems using the example of the Vivace system. In case studies of two festivals in St. Moritz and Abu Dhabi the practical use of this system is presented.

Room enhancement systems

Room enhancement systems are used to adapt the acoustics of venues which are too small or contain too much absorption to the requirements of classical concerts. This is done by picking up the artists on the stage with microphones near the stage, transforming these signals into uncorrelated output signals with additional reflections and reverberation and playing back these signals by numerous loudspeakers distributed throughout the hall.

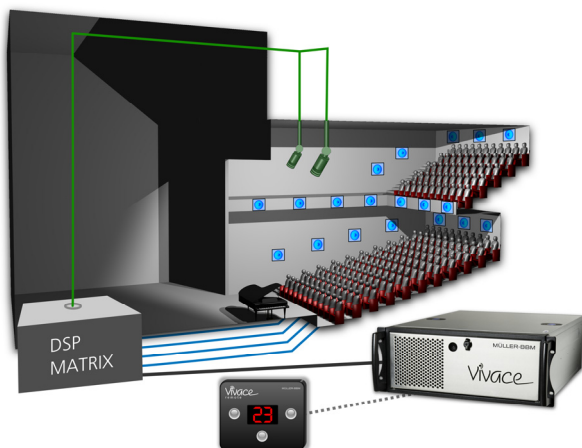


Figure 1: Overview components of a room enhancement system

The main difference to sound reinforcement respectively surround sound applications is the occurrence of feedback, due to the relatively big distance between the artists and the microphones and the use of loudspeakers and microphones with broad directivity. Exceeding a critical limit of feedback

causes the system to add an unnatural coloration to the reverberation because the reverberation time at single frequencies reaches an unnatural value.

There are several methods to deal with this unavoidable feedback. The traditional method is to use a big number of separate and incoherent channels, so that each channel only has to provide a small contribution. Other possibilities are to use microphones with a more narrow directivity as well as directive loudspeakers if installed in vicinity of the microphones. The third and very effective method is to vary the transfer function of the system over time, so that the feedback loses its basis before a colouring excess reverberation can occur. A special variant of this time variance is used in Vivace, which does not use any delay shift, so that pitch shift can not occur. As stated by David Griesinger [1] time variance can shift the limit for perceivable coloration by about 6 dB.

This limit is a crucial value for sound enhancement systems since the perceivable effect of the system depends only partly on the achieved and measured reverberation time.

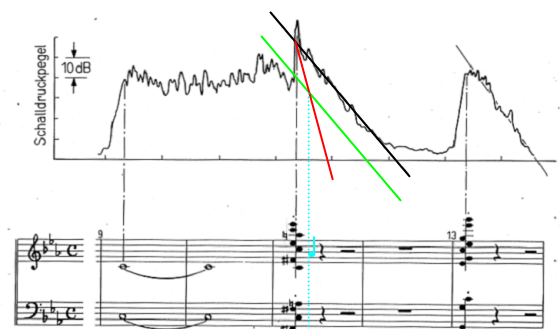


Figure 2: Leveldecay with — long reverberation time, — short reverberation time, — low level of additional reverberation, — Next note would mask the additional reverberation

As shown in figure 2 the ‘running reverberation’ during the music is highly dependent on the level of the early reflections and reverberation.

For the creation of the necessary reflections and reverberation Vivace uses an efficient convolution algorithm so that room impulse responses from measurements in concert halls or churches as well as custom-made impulse responses out of computer simulations can be used. So the impulse response of the existing hall can be supplemented and enhanced with sound energy in exact the time and frequency ranges where it is necessary.

Case studies

Art Masters St. Moritz

In August and September 2008 the first class hotels of St. Moritz in Switzerland accommodated the Art Masters Festival with classical concerts, art exhibitions and various performances. The Vivace system was used in this context to transform dining rooms and hotel halls in three hotels into temporary concert venues for two recitals with the chamber orchestra of the Vienna and Berlin Philharmonic Orchestra and one concert of the brass ensemble of the Mariinsky Theatre conducted by Valery Gergiev.

The volume of these three halls in the Kulm Hotel, the Suvretta Hotel and the Badrutt's Palace were in a range of 1000 to 2600m³ for 200 to 250 listeners. Due to extensive absorption of the thick carpets and absorbent wall claddings in these halls the natural reverberation time was limited to less than 0.8s in all halls.

Since the three concerts took place on three successive days the available installation and preparation time was very short. So especially the installation time for the loudspeakers had to be minimized. As shown in picture 3 the diffuse reflecting ceiling of the halls were utilized for this purpose. With loudspeakers mounted along the side walls and directed to the ceiling a rather smooth sound distribution could be realized in the whole audience area without additional loudspeakers at the ceiling.

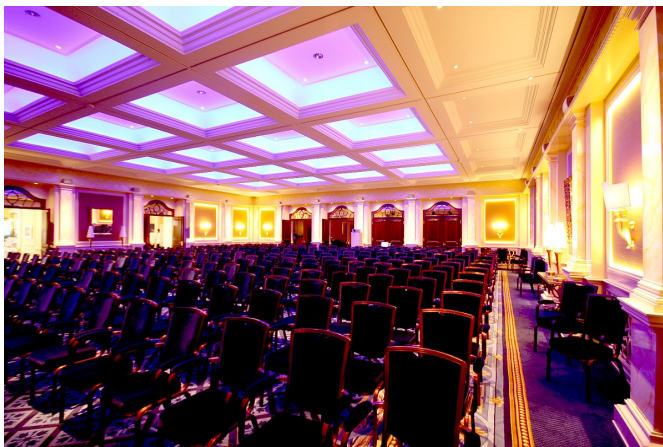


Figure 3: Enhancement Loudspeakers on to of the columns directed to the opposite wall provide a uniform sound distribution in the audience area. (Suvretta Hotel)

Abu Dhabi Classics

The Abu Dhabi Classics (October 2008 – May 2009) are a classical concert festival with the auditorium of the Emirates Palace Hotel as main venue. The festival program consist of a choice of world leading artist with orchestras like the Bayreuth festival orchestra and the Vienna Philharmonic, soloists like Cecilia Bartoli and Lang Lang and conductors like Thielemann, Metha and Maazel.

The auditorium has a volume of 15,000 m³ for 1200 listeners. Designed for electro acoustical reinforced events the unoccupied reverberation time amounts to 1.3s.

Absorbent wall claddings and the huge width of the hall reduce the perceivable spaciousness and envelopment.



Figure 4: Auditorium of the Emirates Palace Hotel

Supplemental to the 32 loudspeakers of the existing surround sound system of the hall 12 additional loudspeakers were installed in the front part of the hall. With these loudspeakers and two microphones in front of the stage and two microphones above the stage reverberation time and reverberation level were raised as shown in figure 5.

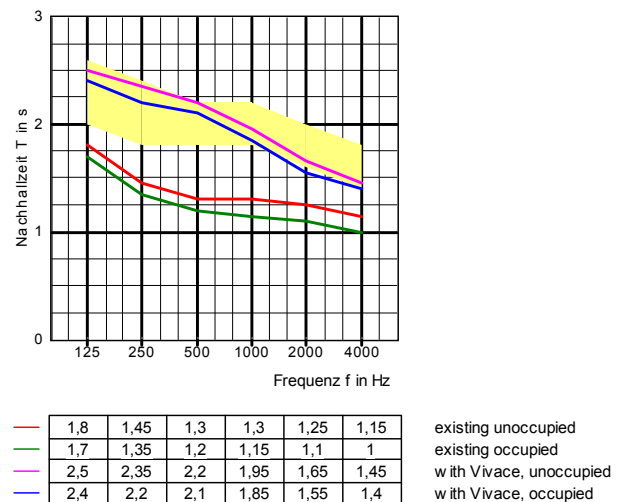


Figure 5: Reverberation times in the auditorium of the Emirates Palace Hotel with / without enhancement system

Without exception the musicians were extraordinary pleased and satisfied with the achieved natural concert sound so that the old fear especially top artists would not tolerate enhancement systems seems to be obsolete.

References

- [1] Griesinger, D.: Improving Room Acoustics Through Time-Variant Synthetic Reverberation, AES 90th Paris (1991)
- [2] Walter, F. et al: On the measurement of electro acoustic enhanced sound fields, AES 124th Amsterdam (2008)